Recap

Logic: Resolution Proofs

CPSC 322 - Logic 5

Textbook §5.2

Logic: Resolution Proofs

CPSC 322 - Logic 5, Slide 1

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Lecture Overview





Logic: Resolution Proofs

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Soundness and completeness of bottom-up proofs

- Proved soundness of bottom-up proof procedure
 - assuming that there is a g such that $KB \vdash g$ and $KB \not\models g$ leads to a contradiction
- Proved completeness of bottom-up
 - construct a minimal model
 - $\bullet\,$ every atom in C is true, all others are false
 - proved this is indeed a model
 - used the existence of the minimal model to show that $KB \models g$ implies that $KB \vdash g$.

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Lecture Overview





Logic: Resolution Proofs

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Top-down Ground Proof Procedure

Idea: search backward from a query to determine if it is a logical consequence of KB. An answer clause is of the form:

$$yes \leftarrow a_1 \land a_2 \land \ldots \land a_m$$

The SLD Resolution of this answer clause on atom a_i with the clause:

$$a_i \leftarrow b_1 \land \ldots \land b_p$$

is the answer clause

$$yes \leftarrow a_1 \wedge \cdots \wedge a_{i-1} \wedge b_1 \wedge \cdots \wedge b_p \wedge a_{i+1} \wedge \cdots \wedge a_m.$$

Derivations

- An answer is an answer clause with m = 0. That is, it is the answer clause yes ← .
- A derivation of query " $?q_1 \land \ldots \land q_k$ " from KB is a sequence of answer clauses $\gamma_0, \gamma_1, \ldots, \gamma_n$ such that
 - γ_0 is the answer clause $yes \leftarrow q_1 \land \ldots \land q_k$,
 - γ_i is obtained by resolving γ_{i-1} with a clause in KB, and
 - γ_n is an answer.

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To solve the query ?q_1 \land \ldots \land q_k:
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$$ac := "yes \leftarrow q_1 \land \ldots \land q_k"$$

repeat

select atom a_i from the body of ac; choose clause C from KB with a_i as head; replace a_i in the body of ac by the body of Cuntil ac is an answer.

Recall:

- Don't-care nondeterminism If one selection doesn't lead to a solution, there is no point trying other alternatives. select
- Don't-know nondeterminism If one choice doesn't lead to a solution, other choices may. choose

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$$\begin{array}{lll} a \leftarrow b \wedge c. & a \leftarrow e \wedge f. & b \leftarrow f \wedge k. \\ c \leftarrow e. & d \leftarrow k. & e. \\ f \leftarrow j \wedge e. & f \leftarrow c. & j \leftarrow c. \end{array}$$

Query: ?a

$$\begin{array}{lll} \gamma_0: & yes \leftarrow a & & \gamma_4: & yes \leftarrow e \\ \gamma_1: & yes \leftarrow e \wedge f & & \gamma_5: & yes \leftarrow \\ \gamma_2: & yes \leftarrow f & & \\ \gamma_3: & yes \leftarrow c & & \end{array}$$

Logic: Resolution Proofs

Example: failing derivation

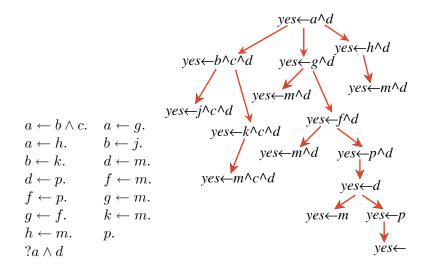
Query: ?a

 $\begin{array}{ll} \gamma_0: & yes \leftarrow a \\ \gamma_1: & yes \leftarrow b \wedge c \\ \gamma_2: & yes \leftarrow f \wedge k \wedge c \\ \gamma_3: & yes \leftarrow c \wedge k \wedge c \end{array}$

 $\begin{array}{ll} \gamma_4: & yes \leftarrow e \wedge k \wedge c \\ \gamma_5: & yes \leftarrow k \wedge c \end{array}$

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Search Graph



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